STEMED – NMSU *STEM* training, *E*ntrepreneurship and *D*iversity

Marie Borchert[1], Susan Brown[2], Enrico Pontelli[3]

[1]Arrowhead Center

[2]NMSU STEM Outreach Office

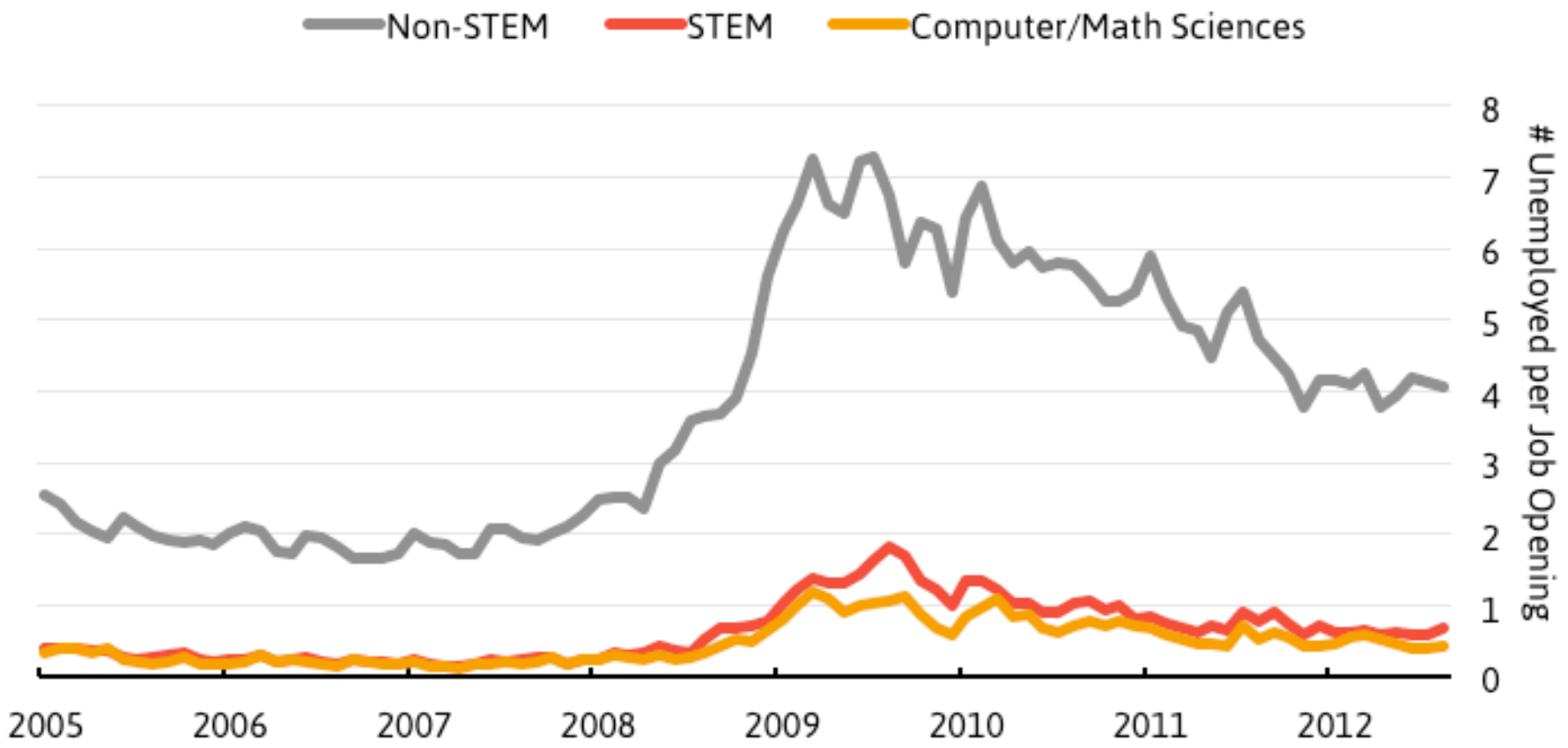
[3]Department of Computer Science

New Mexico State University

The Need: STEM Jobs

- STEM Opportunities are Exploding!
- Nationally
  - 26 million STEM jobs in the US
  - An expected growth of 1.2M jobs by 2018
  - Growing at double the rate of other occupations
- Specific emphasis
  - Engineering and Computer Science
  - Combined over 70% of job growth
  - Critical to most other disciplines
  - Occupy 5 of the top 10 fastest growing occupations

The Need: STEM Jobs



The Need: STEM Jobs

TOP 10 SALARIES FOR UNDERGRADUATE DEGREES, 2013

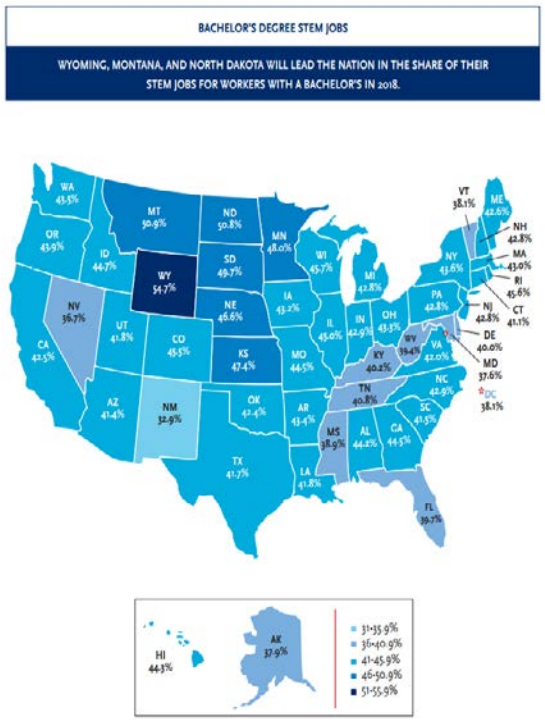
UNDERGRADUATE DEGREE	Starting Salary	Mid-career Salary
Petroleum Engineering	$98,000	$163,000
Chemical Engineering	$67,500	$111,000
Nuclear Engineering	$66,800	$107,000
Electrical Engineering (EE)	$63,400	$106,000
Computer Engineering (CE)	$62,700	$105,000
Aerospace Engineering	$62,500	$118,000
Computer Science (CS)	$58,400	$100,000
Actuarial Mathematics	$56,100	$112,000
Applied Mathematics	$50,800	$102,000
Statistics	$49,300	$99,500

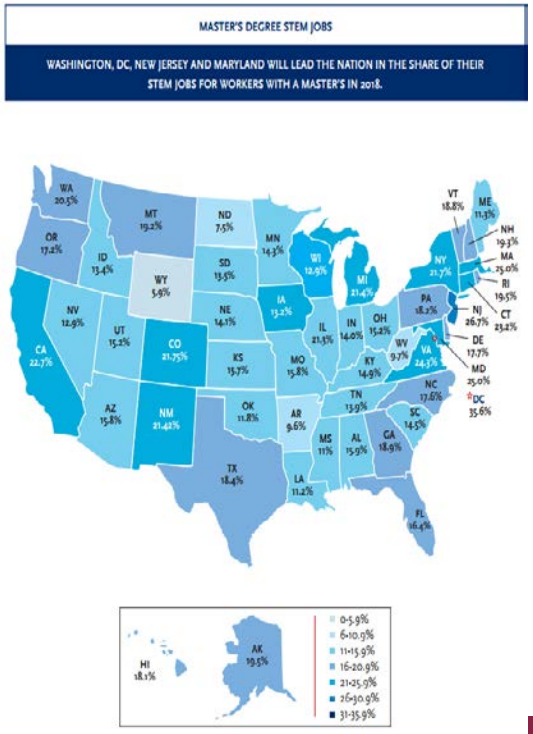
 Source: http://www.payscale.com/college-salary-report-2014/majors-that-pay-you-back

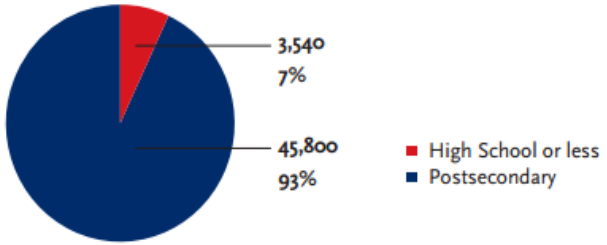
ncwit.org/scorecard

The Need: STEM Jobs

- New Mexico
  - Forecast of over 53,000 STEM jobs by 2018

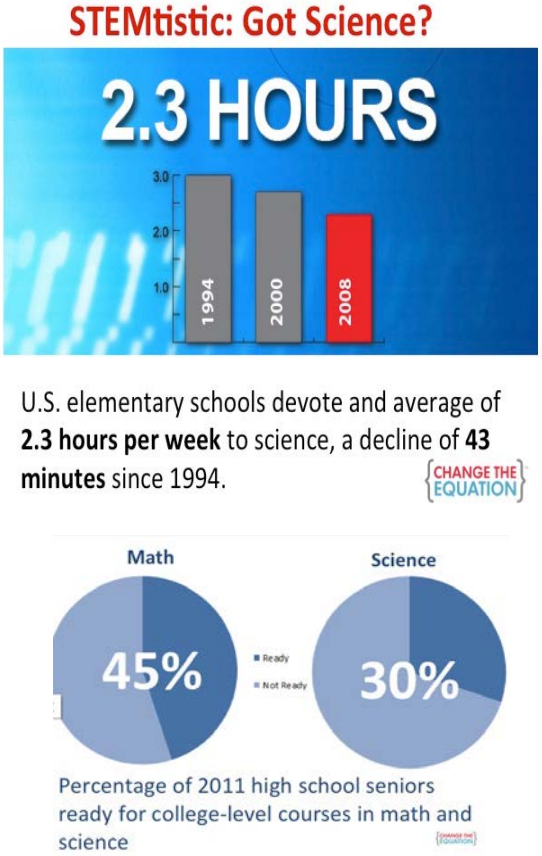






The Need: Shortage of Workforce

- Demand not met by Supply
  - STEM interest at high school level below 2000 levels (e.g., 37% males, 14% females)
  - Over 57% of high school freshmen lose interest in STEM by their senior year
  - Over 48% of college freshmen abandoned their STEM paths
  - Depending on discipline – supply meets anywhere between 30% to 75% of demand



The Need: Underrepresentation (Gender)

63 Percent of 2013 Intel Science and Engineering Fair (ISEF) finalists in Biochemistry who were female

25 Percent of 2013 ISEF finalists in Mathematics who were female

14 Percent of 2013 ISEF finalists in Computer Science who were female

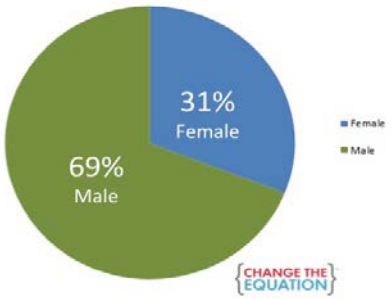
26 Percent of computing workforce who were women in 2013

3 Percent of computing workforce who were African-American women in 2013

5 Percent of computing workforce who were Asian women in 2013

2 Percent of computing workforce who were Hispanic women in 2013

Only 31% of STEM degrees are awarded to women



57 Percent of 2012 undergraduate degree recipients who were women

18 Percent of 2012 Computer and Information Sciences undergraduate degree recipients who were women

12 Percent of 2012 Computer Science undergraduate degree recipients at major research universities who were women

37 Percent of 1985 Computer Science undergraduate degree recipients who were women

64 Percent decline in the number of first-year undergraduate women interested in majoring in Computer Science between 2000 and 2012

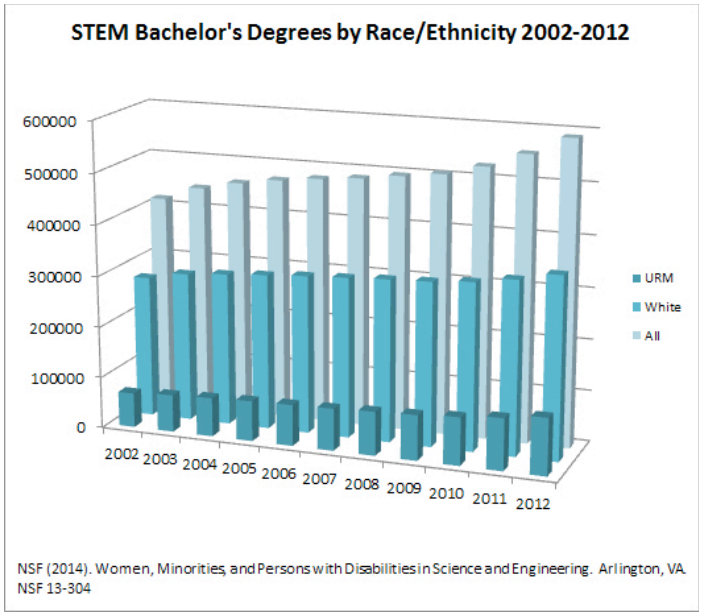
57 Percent of professional occupations in the 2013 U.S. workforce held by women

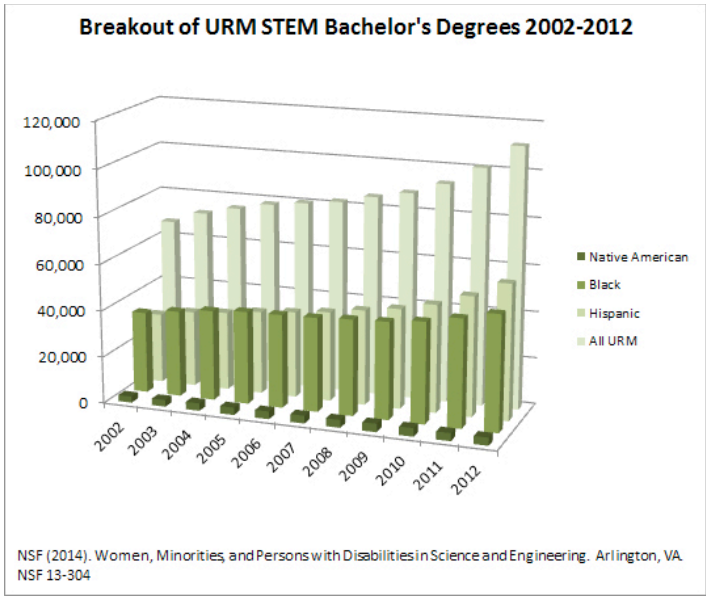
26 Percent of professional computing occupations in the 2013 U.S. workforce held by women

24 Percent of Chief Information Officer (CIO) positions at Fortune 100 companies held by women in 2012

The Need: Underrepresentation (Ethnicity)

- 17.7% of STEM degrees to underrepresented minority students (8% for Hispanic students)
  - 13.7% at the Master's level
  - 11.5% at the Doctoral level (4% for Hispanic students)





Why?

- Academic gap in science and math within high school
  - Lack of formal preparation
  - Lack of awareness (e.g., computing)
- Disadvantage in preparation in early STEM college courses (e.g., male vs female)
  - Lack of confidence
- Interest drop towards technical STEM in the transition from middle school to high school and from high school to college
- Various Factors, e.g.,
  - Differences in socialization patterns
  - Lack of role models
  - Lack of family support (technology = male/father)
  - Stereotypes and Negative Images

Research Foundations

1. Preparation gap and stereotypes deter from pursuit of STEM and computing, reduce confidence and impact attitude
2. Minority achievement in STEM can be bolstered through academic clubs and social infrastructures
3. Mastery experiences improves self-efficacy and success in STEM
4. K-12 support networks are critical to improve recruitment and retention of Hispanics in STEM
5. Hispanic cultural values are well-aligned with principles and practices of STEM (especially in areas like engineering and computing)
6. Social impact and relevance is an effective mechanism to engage young women in the learning of STEM

Exemplary Programs: SEMAA

- Southern New Mexico Science, Engineering, Mathematics, and Aerospace Academy
- Goals:
  1. Encourage underrepresented students in grades K-12 into the fields of STEM
  2. Engage students in inquiry-based learning, research, use of advanced technologies, peer support groups, and mentoring relationships with professionals in the STEM fields.

Exemplary Programs: SEMAA

3. Facilitate the successful transition of students from high school to post-secondary programs in the STEM fields.
4. Develop partnerships with parents.
5. Provide opportunities for pre-service and engineering students to work with local schools and communities and to assist in-service teachers with implementing curriculum.

Exemplary Programs: SEMAA

- Sample Activities
  - The SEMAA Aerospace Education Lab (AEL)
    - Computerized real aerospace hardware and software
    - Advanced Flight Simulator
    - Research wind tunnel
    - AR Drones
    - GPS for aviation
  - Moonbuggy Race Competition
    - Engineering design and proof-of-concept
    - High School competition

- Sample Accomplishments
  - 42 schools, over 30,000 students in 14 years
  - 8-week and 16-week after school programs
  - National awards

Exemplary Programs: YWiC

- Young Women in Computing
  - Active since 2008
  - Focus on engaging, training and supporting young women in the pursuit of education in computing
  - Extensive collection of activities
    - Summer camps (middle and high school)
    - Social networks
    - Roadshows and school presentations
    - Community events
    - Afterschool programs
    - Competitions
    - …
  - Conduit for national programs

Exemplary Programs: YWiC

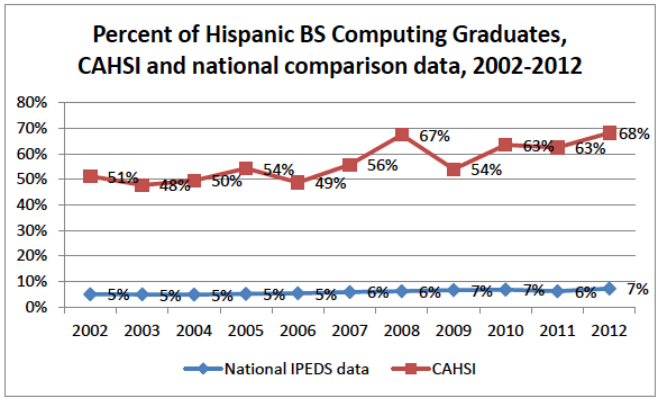
- Over 9,500 students & professionals served
- Over 420 female summer camp participants
- 152 camp alum have graduated from high school
- 100% matriculated to college
- 62% are majoring in STEM fields
- 81% attend NMSU
- 24% CS Department is now female (up from 8%)
- 53% Hispanic participants
- 55 total weeks of summer camp provided
- 20 platforms of instruction
- 297 workshops, conferences, roadshows, field trips, informal educational activities, forums.
- Over 65 collaborative efforts

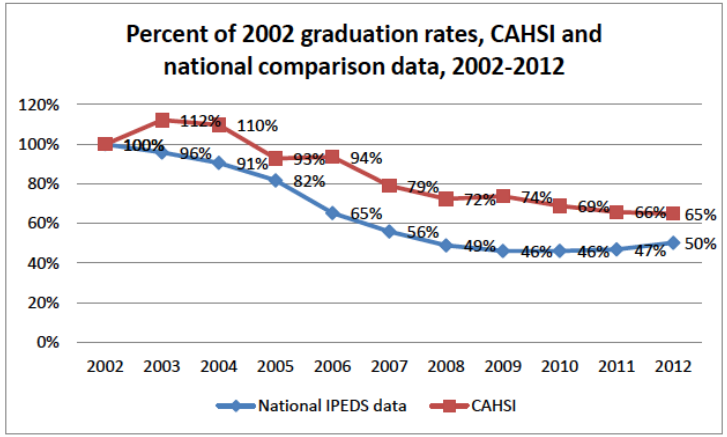
Exemplary Programs: YWiC

- Success stories
  - N. Nesiba: Google Ambassador, Graduate Student, Nesiba scholarship
  - S. McGuinn and N. Muhyi: NCWIT Aspirations in Computing
  - N. Muhyi: 2012 Presidential Science Fair
  - H. Walker: MIT CS
  - …

Exemplary Programs: CAHSI

- Computing Alliance of Hispanic Serving Institutions
  - Create a unified voice in an effort to consolidate the strengths, resources, and concerns to increase the number of Hispanics who pursue and complete baccalaureate and advanced degrees in computing areas
  - Best Practices
    - CS0
    - Peer Led Team Learning for computing
    - Affinity Research Groups





From STEMD To STEMED

- STEM/Diversity + Entrepreneurship
- Students rarely have the natural ability to:
  - Apply learned STEM concepts with real-world problems
  - Find and pursue opportunities by applying their knowledge to the world around them
- Training in *entrepreneurial thinking* helps bridge this gap
  - Facilitates integration and exploration of approaches to solving problems in diverse contexts
  - It emphasizes imagining new possibilities
  - It emphasizes the cross pollination of ideas
- The problems we face will only continue to become more complex (global warming, health issues, energy, population increases)

From STEMD to STEMED

- Entrepreneurship thinking skills *can be acquired*
- The necessary cognitive skills are enhanced and refined through frequent exposure to entrepreneurial experiences
- These experiences can come through a variety of avenues
  - project-based courses
  - summer camps
  - competitions
  - Anything that provides direct experience to students in entrepreneurship with different levels of complexity

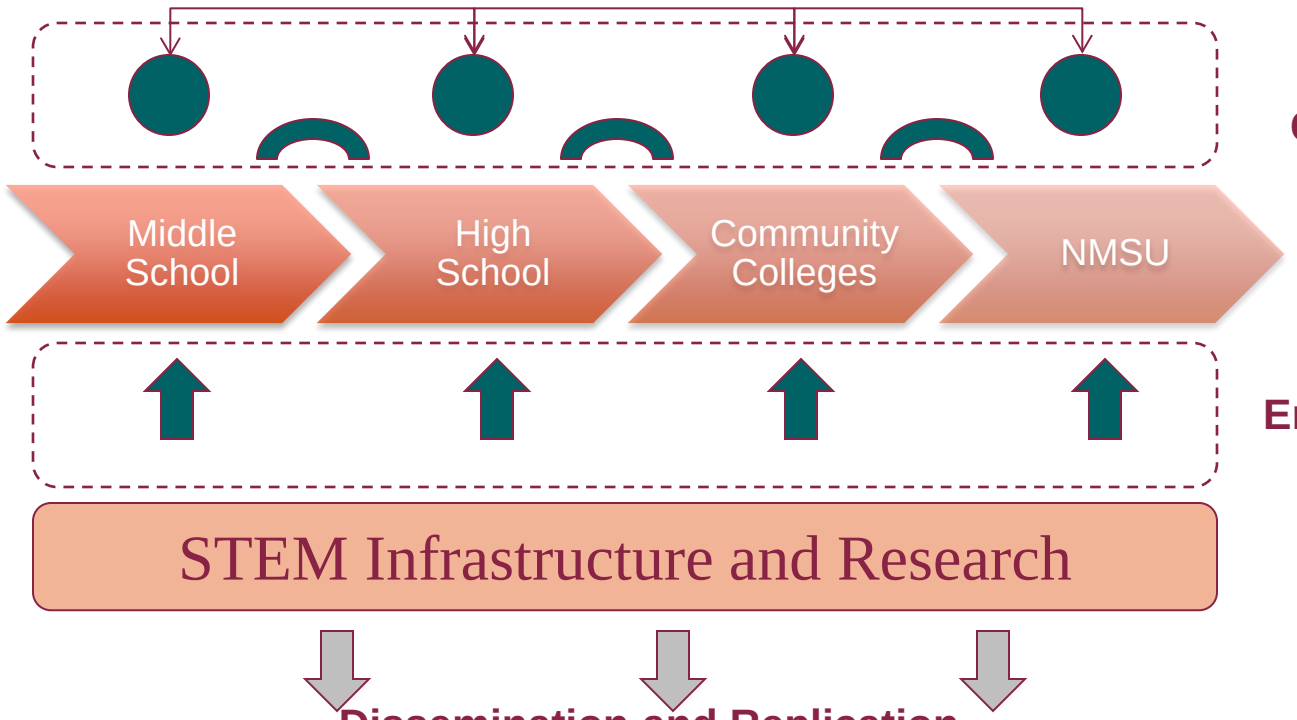
Exemplary Program: Innoventure

- NMSU Innoventure program already works with middle and high school students across the state
  - Student teams
  - build a functional prototype (STEM)
  - develop a business around that product
- Camp Innoventure provides experiences to middle school students locally
  - Summer camp
  - Learn basics of entrepreneurship
  - Make and sell a product at the Las Cruces Farmer's market
- Innoventure Jr. explores entrepreneurship at the elementary level

STEMED at NMSU

- Objectives
  - Create an institution-wide umbrella for STEMED
  - Share, replicate, adapt successful efforts
  - Move STEMED initiatives out of single-discipline/single-focus/single-entity silos and into an holistic view of STEMED
  - Share across the state through Cooperative Extension Services

- Ambitious Vision



Thank You

Questions?